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Boosting the use of air quality satellite data

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Aura Science Team meeting, Pasadena, 27-29.10. 2019

Introduction

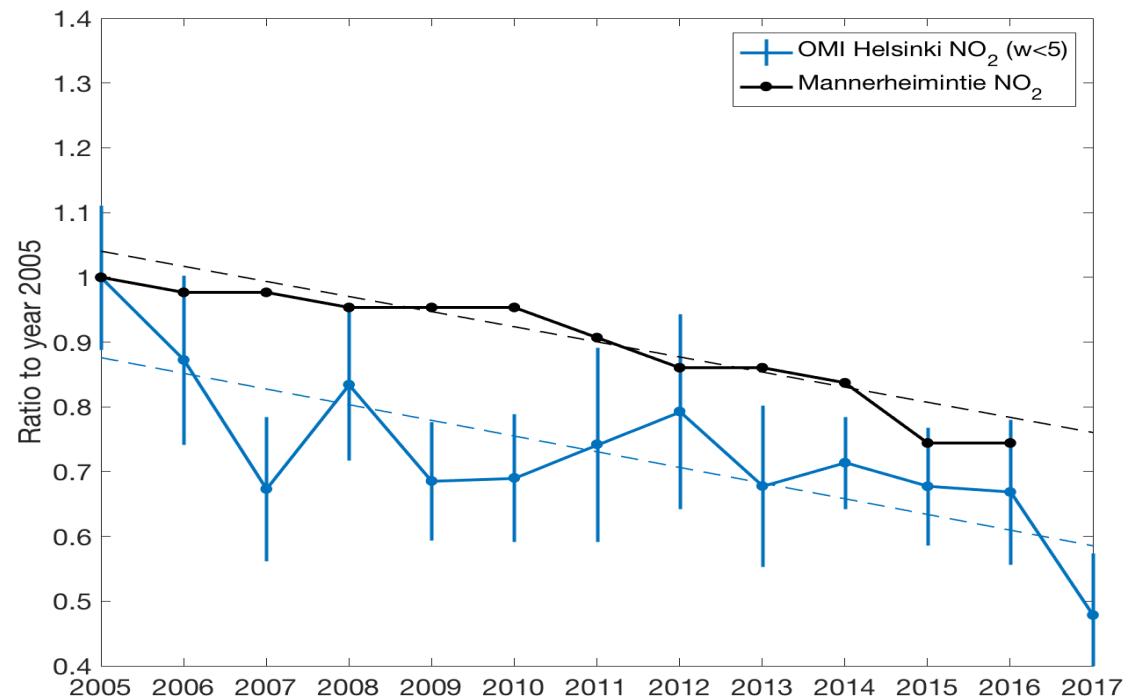
- The European Union's air quality directive (2008/50/EC **Directive on Ambient Air Quality and Cleaner Air for Europe**) regulates the air quality (NO_2 , O_3 , PM) in the EU.
- The directive also defines how the reference measurements by national/local authorities should be done and reported. In case of exceeding given thresholds, authorities must develop and implement air quality management plans.
- **Satellite data is presently not recognized by the regulation as a valid method, even though modeling is mentioned to be used when the air is expected to be clean.**
- Motivated by this, the Ministry of the Environment in Finland put up a small one year feasibility project: **Air quality monitoring using satellite observations.**

Air quality monitoring using satellite observations, a feasibility study project

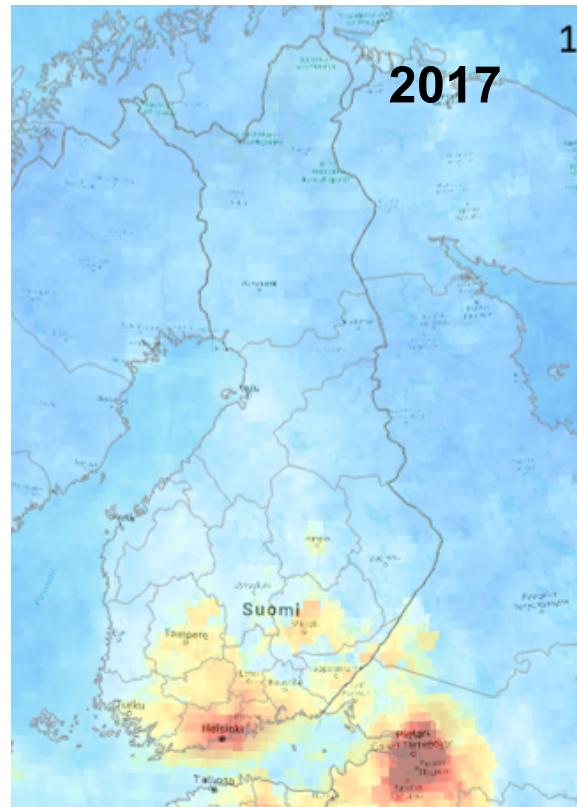
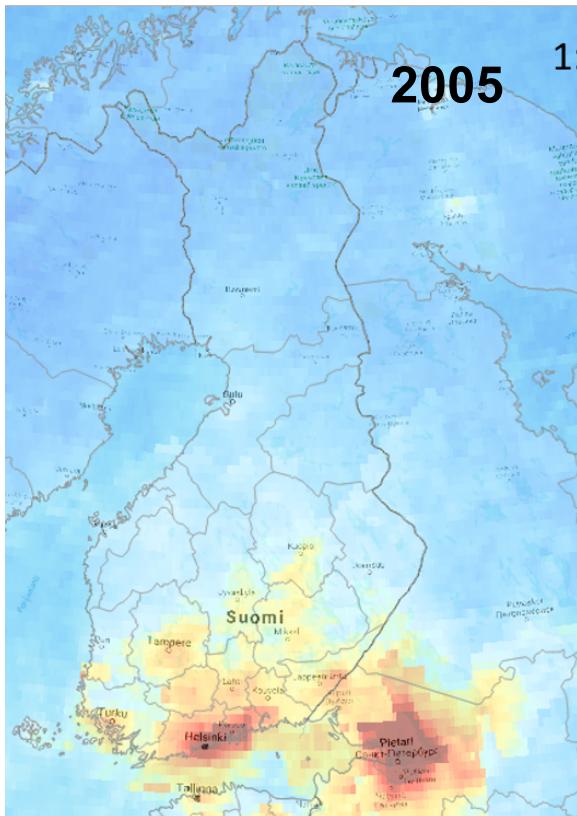
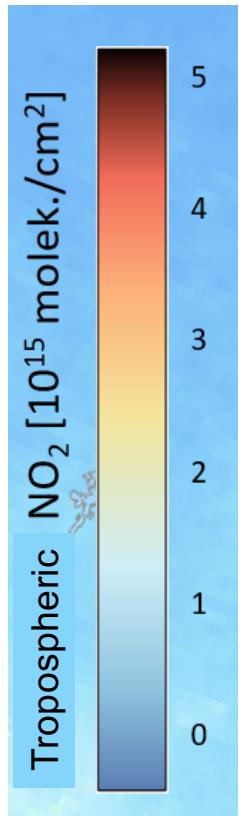
Funded by the Ministry of the Environment, Finland

- Analyse and provide examples temporal variability of NO₂ using OMI data in Finland and regions nearby.
- Demonstrate capabilities of using TROPOMI observations by comparisons with in-situ air-quality measurements and Pandora.
- Analyse if satellite observations could be used to guide where the air quality observations should take place.

OMI NO₂ vs. in-situ observations in Helsinki 2005 - 2017



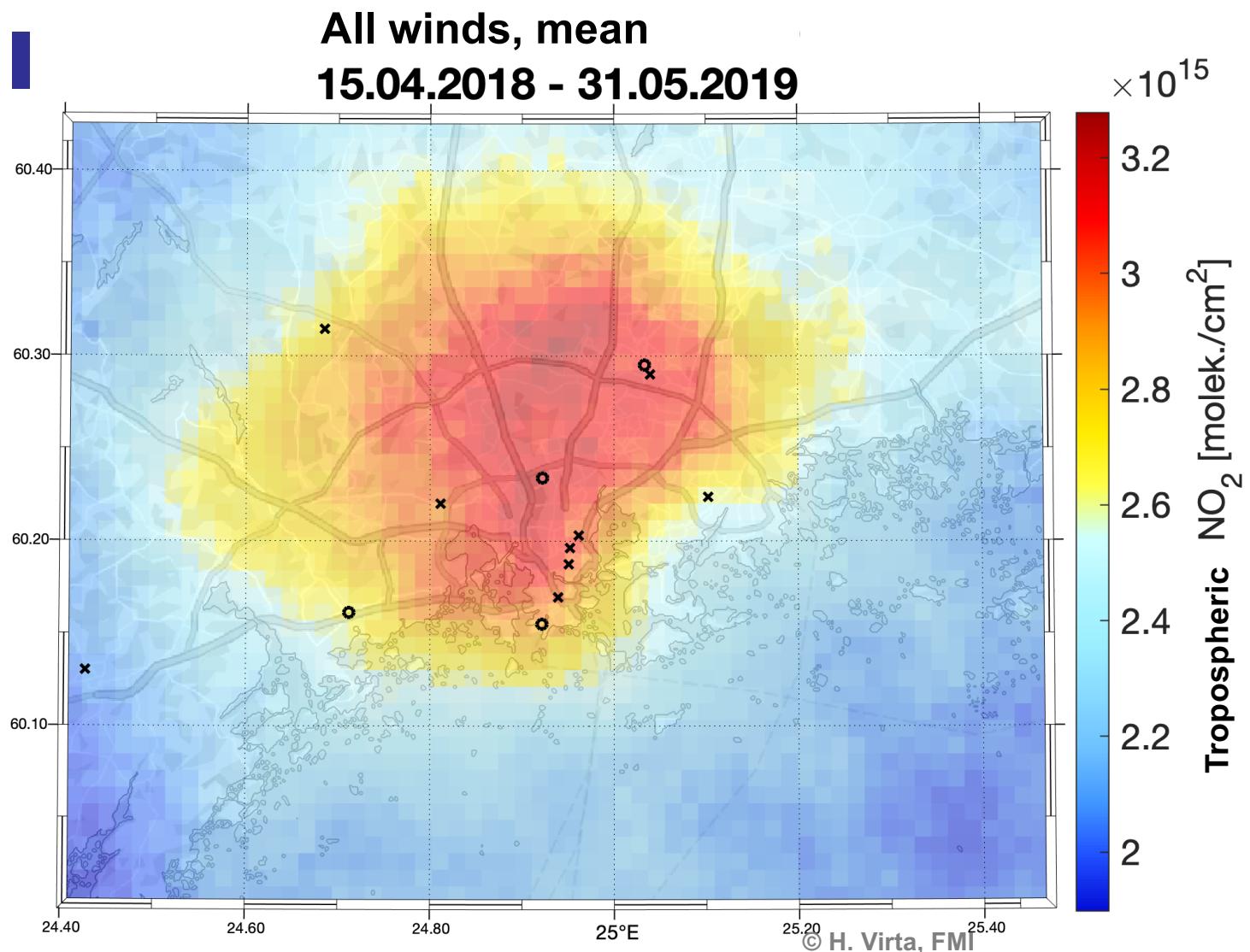
OMI NO₂ over Finland 2005 vs 2017



© S-T. Haakana, FMI

TROPOMI NO₂

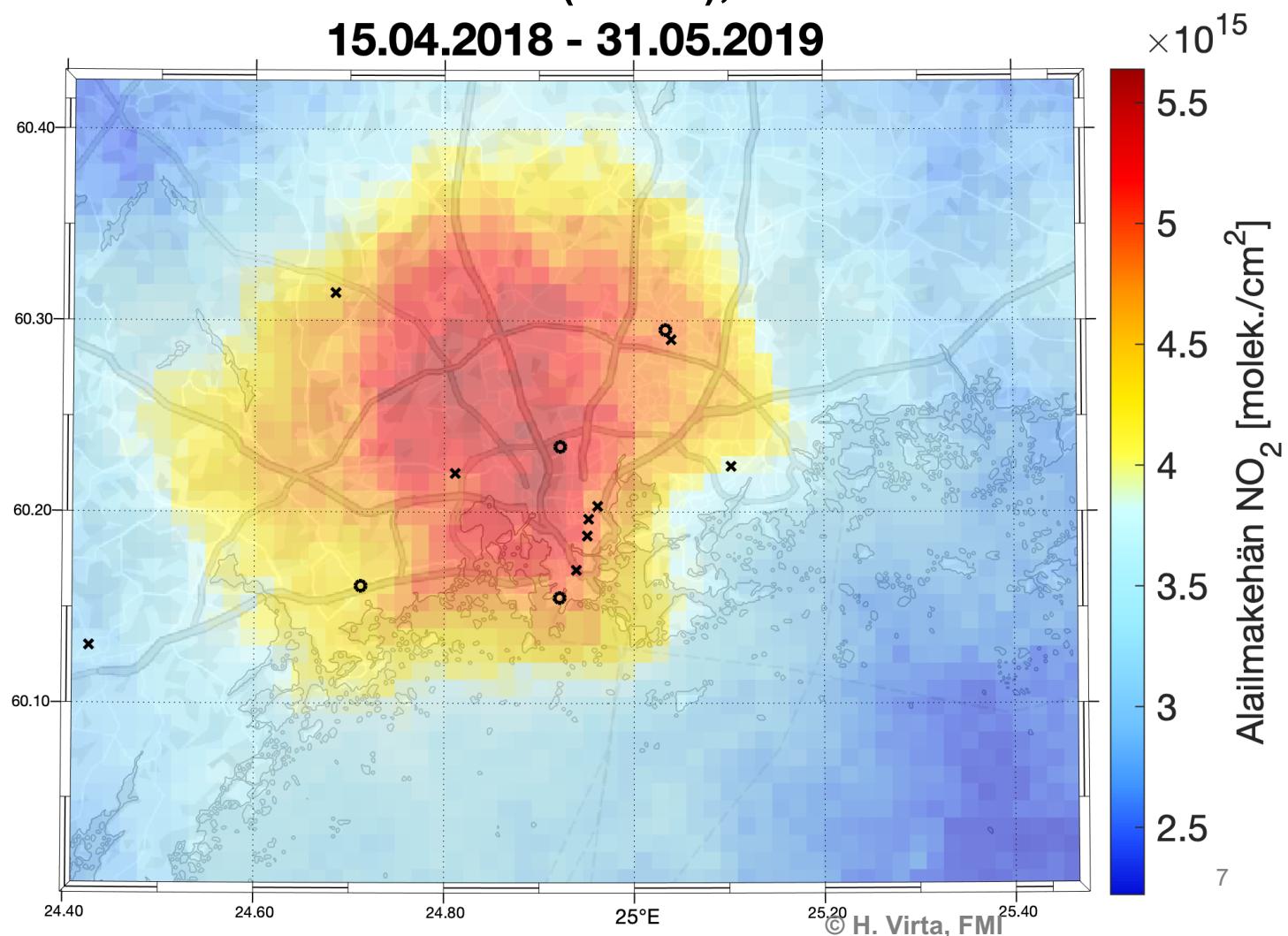
- TROPOMI NO₂
all wind
- Typical wind
directions
south-west and
west.



TROPOMI NO₂

- TROPOMI NO₂ weak wind data

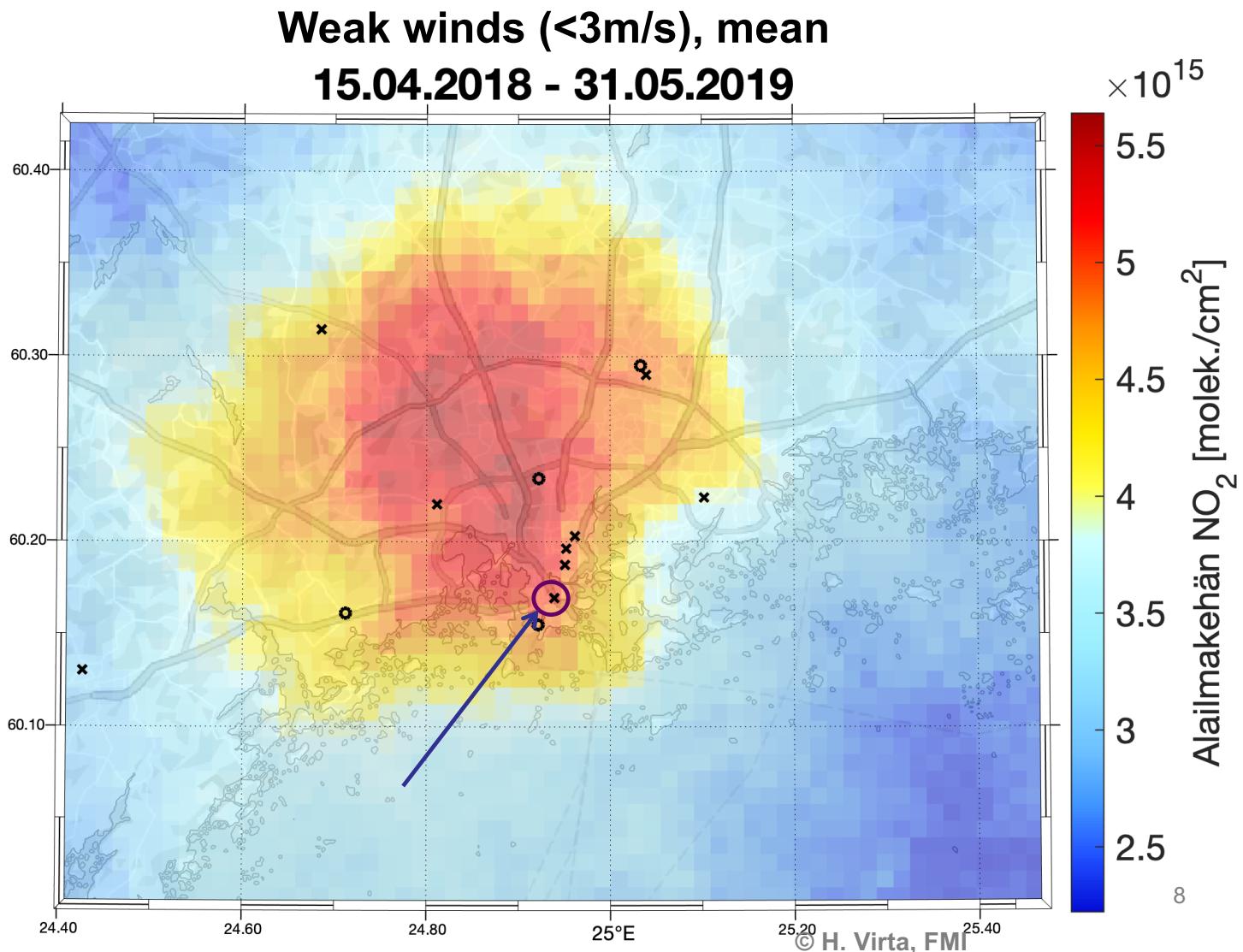
Weak winds (<3m/s), mean
15.04.2018 - 31.05.2019



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TROPOMI NO₂

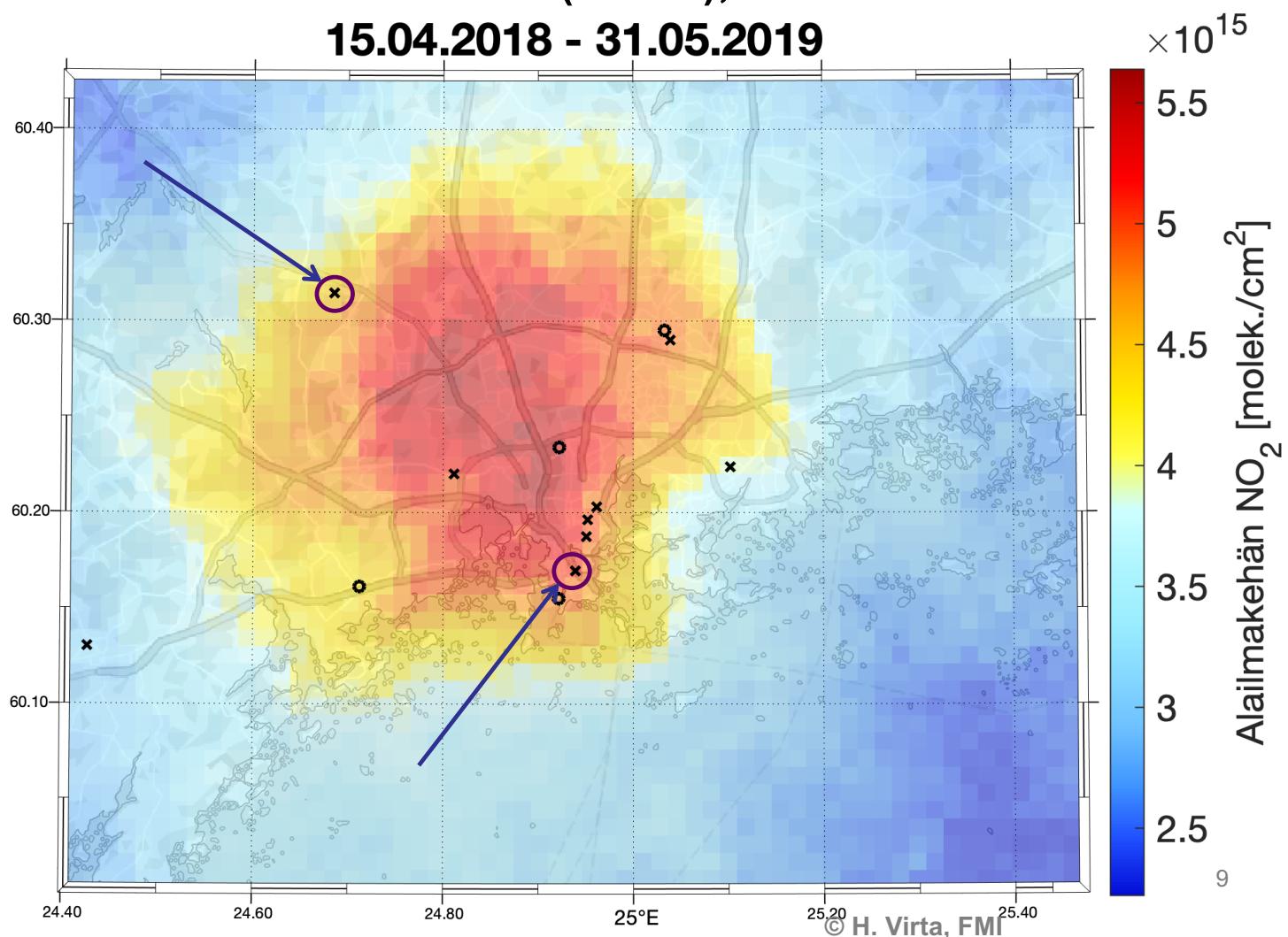
- TROPOMI NO₂ weak wind data
- Highest values closer to most busy roads, not the centre



TROPOMI NO₂

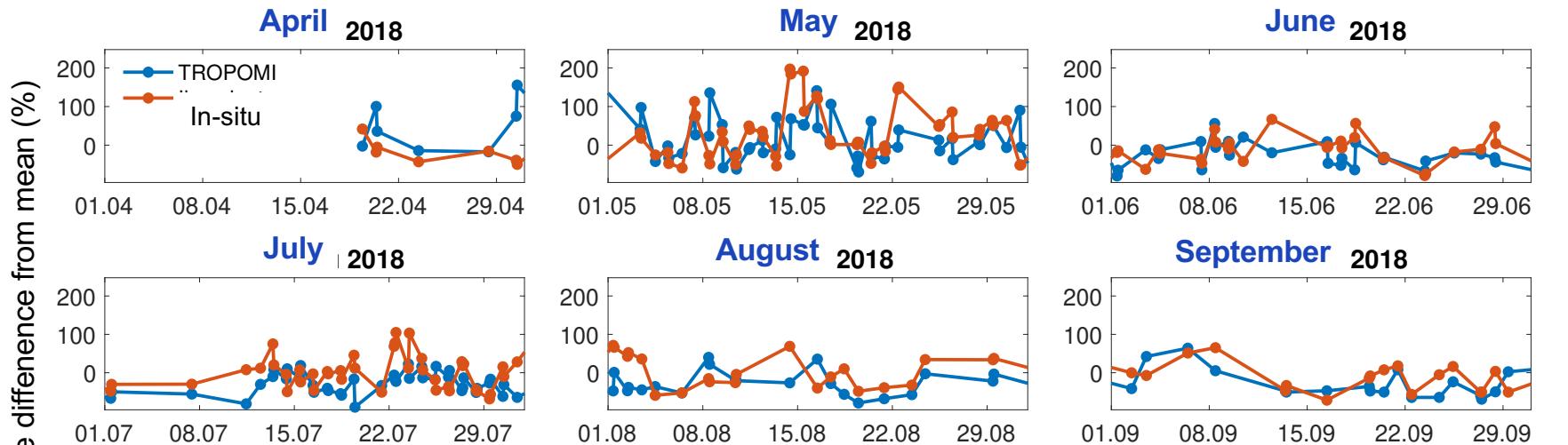
- TROPOMI NO₂ weak wind data
- Highest values closer to most busy roads, not the centre
- Remote sites are not really background

Weak winds (<3m/s), mean
15.04.2018 - 31.05.2019

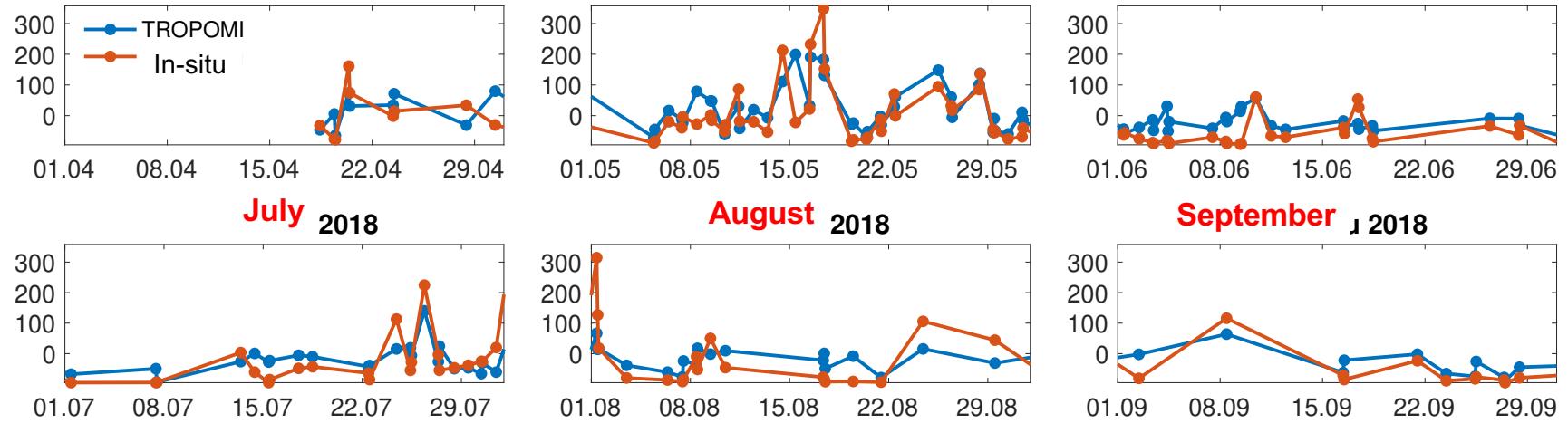


TROPOMI NO₂ vs air quality stations

**City
centre**



**Luukki
golf court
background
station**

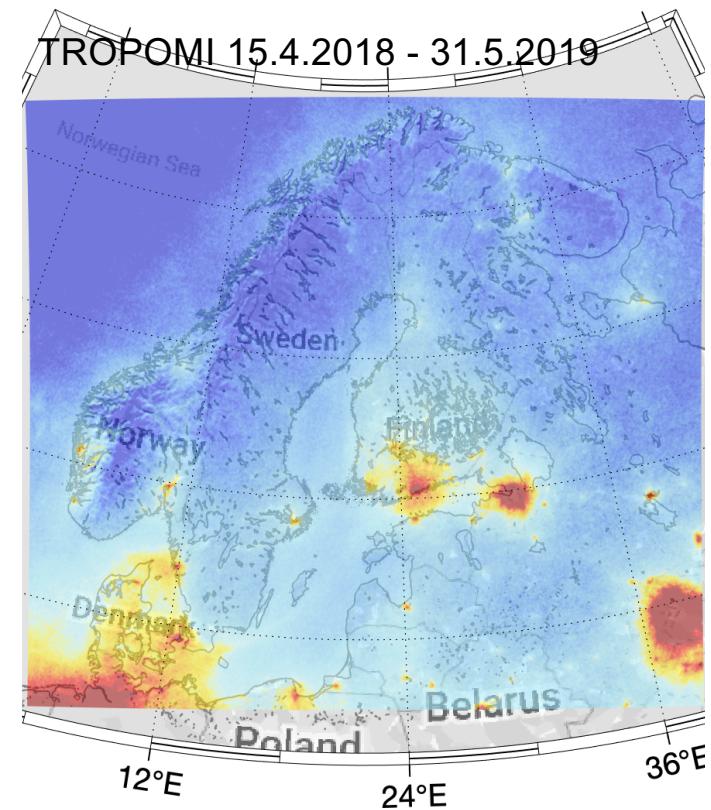
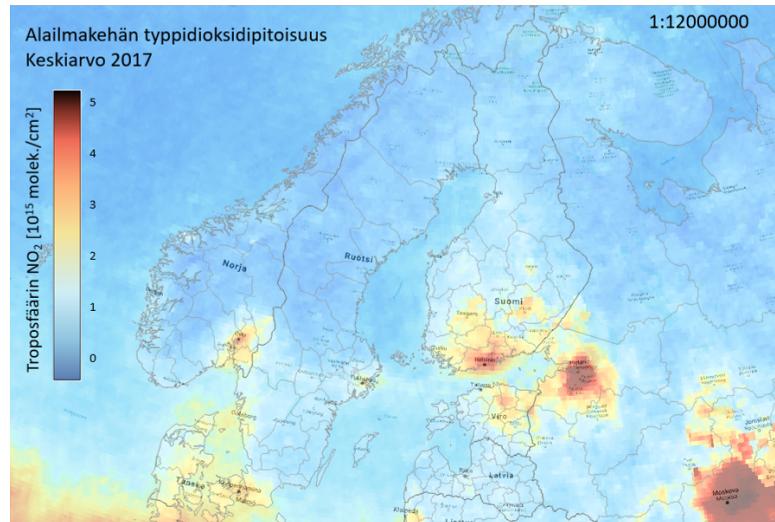


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OMI/TROPOMI NO₂ over Nordic countries

- Clearly higher NO₂ values in Southern Finland compared to Sweden and Estonia.
- Air quality stations report similar NO₂ values in Helsinki and Stockholm
- Typical wind direction from the west may play role
- The difference is not as large in slant columns.

OMI 2017



Summary

- OMI and TROPOMI NO₂ data are analysed over Finland and neighboring regions.
- Similar overall long term trend found with in-situ NO₂ observations and OMI.
- Direct comparison of TROPOMI daily NO₂ and air quality stations shows similarities, but the agreement depends on wind and the variability.
- Satellite data can give advice where to locate the in-situ air quality stations.
- We are puzzled about the big difference in tropospheric NO₂ in Finland, Sweden, Estonia, Norway.

New fans of OMI data: President Niinistö and Minister Marin.

